Differential Equations - equation involving derivatives

- order refers to order of highest derivative

Ways you will see them:

$\boxed{\text{Exact}}$

$\frac{dy}{dx} = \sec^2 x + 2x + 5$ → find all functions, y, that satisfy the differential eq.

$y = \tan x + x^2 + 5x + C$ (Not unique)

<u>initial value Problem</u> find the function y that passes through the point (0, 6)

$y = \tan x + x^2 + 5x + 6, \quad -\frac{\pi}{2} < x < \frac{\pi}{2}$

Try these - Find all functions that satisfy

① $\frac{dy}{dx} = 7x^6 - 3x^2 + 5$ and passing through pt. $(1,1)$

$y = x^7 - x^3 + 5x - 4$

$y = x^7 - x^3 + 5x + C$

$1 = (1)^7 - (1)^3 + 5(1) + C$

$1 = 5 + C$

$C = -4$

② $\frac{dy}{dx} = e^x - 6x^2$ through pt. $(1,0)$

$y = e^x - 2x^3 - e + 2$

$y = e^x - 2x^3 + C$

$0 = e^1 - 2(1)^3 + C$

$0 = e - 2 + C$

$C = 2 - e$

③ $\frac{dy}{dx} = 2x - \sec^2 x$ through pt. $(0,3)$

$y = x^2 - \tan x + C$

$$\boxed{y = x^2 - \tan x + 3, \quad -\frac{\pi}{2} < x < \frac{\pi}{2}}$$

Other ways

$\boxed{\text{Using Fundamental Thrm}}$

$y' = e^{-x^2}$, Find solution function, y, such that $f(7) = 3$

$$y = \int_7^x \left(e^{-t^2}\right) + 3$$

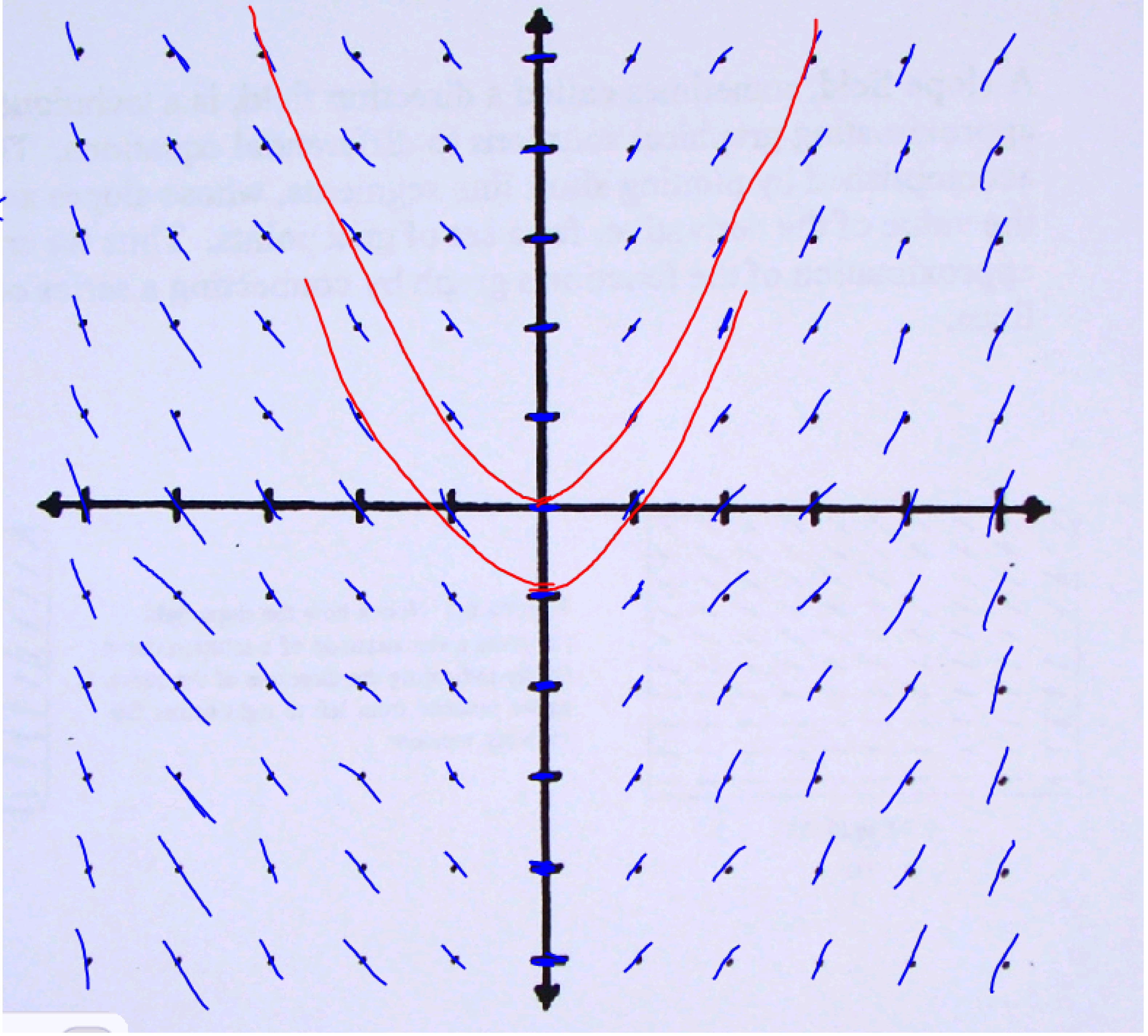
$f(2)$

$NINT\left(e^{-x^2}, x, 7, 2\right) + 3$

$\boxed{\text{Graphing}}$

$\frac{dy}{dx} = 2x$

$y = x^2 + C$



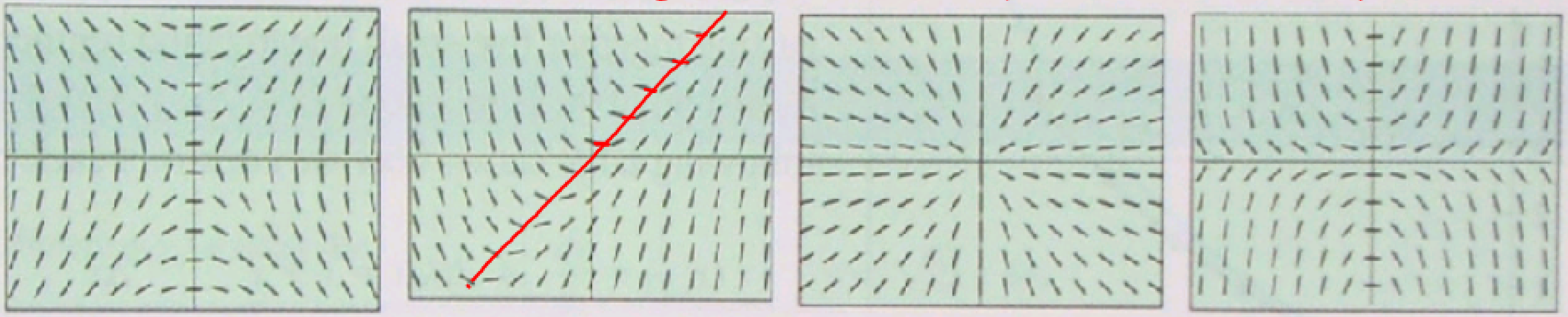
Use slope analysis to match each of the following differential equations with one of the slope fields (a) through (d). (Do not use your graphing calculator.)

1. $\dfrac{dy}{dx} = x - y$ b ✓

2. $\dfrac{dy}{dx} = xy$ ~~a~~, b ✓

3. $\dfrac{dy}{dx} = \dfrac{x}{y}$ d, a

4. $\dfrac{dy}{dx} = \dfrac{y}{x}$ c, d



(a) (b) (c) (d)

6.1 Do Quick Review, 1-24 (4 each sect.), 25-40, 49, 50